

**APPENDIX B  
SEDIMENT BIOLOGICAL TOXICITY  
DATA QUALITY REVIEW AND  
BIOLOGICAL TOXICITY TESTING REPORT**

## APPENDIX B SEDIMENT BIOLOGICAL TOXICITY DATA QUALITY REVIEW AND BIOLOGICAL TOXICITY TESTING REPORT

### ***B.1 Introduction***

Parametrix, Inc., of Kirkland, Washington, was contracted to conduct bioassays of sediments collected as part of a Dredged Material Management Program (DMMP) sediment characterization study for Peratrovich, Nottingham & Drage, Inc., and Hart Crowser, Inc.

Bioassays were conducted by Parametrix's Environmental Toxicology Laboratory, a State of Washington-accredited laboratory (Lab accreditation number C033: Expiration September 30, 2000). Parametrix's Environmental Toxicology Laboratory is certified to perform the sediment bioassays under the Puget Sound Estuary Program (PSEP, 1995) and DMMP protocols.

### ***B.2 Sediment Bioassay Data Quality Review***

Three test sediments were collected by Hart Crowser personnel on February 17, 1999 (Sample ID C8) and February 18, 1999 (C9 and C1), and provided to Parametrix on February 22, 1999. A reference sediment sample was collected by Bio-Marine Services, of Seattle, Washington, from Carr Inlet and delivered to Parametrix on April 13, 1999.

A suite of three bioassays was conducted on one of the test sediments (C8) and the reference sediment:

- ▶ 10-day amphipod mortality test using *Ampelisca abdita*
- ▶ 20-day juvenile polychaete growth test using *Neanthes arenaceodentata*
- ▶ 96-hour sediment larval test using *Strongylocentrotus purpuratus*

The following criteria were evaluated as part of this data quality review:

- ▶ Chain of custody procedures and sample holding procedures;
- ▶ Evaluation of data completeness and transcription accuracy;
- ▶ Bioassay test conditions (water quality assurance parameters);
- ▶ Bioassay performance in negative control and reference sediments; and
- ▶ Bioassay performance in positive control tests.

Laboratory performances in the sediment bioassays were evaluated against the PSEP (1995) protocols, the Sediment Management Standards: Marine Bioassays Recommended Quality Assurance and Quality Control Deliverables (Ecology,

1996), and the Dredged Material Evaluation and Disposal Procedures Manual (Corps, 2000).

### **B.2.1 Chain of Custody Procedures and Sample Holding**

Samples were transferred to the bioassay testing laboratory using established chain of custody procedures. Test and reference sediments were purged with nitrogen on receipt at the testing laboratory and held in the dark at 4°C until tested. Sediment larval bioassay testing was initiated on April 13, 1999, 55 days after sample collection. Amphipod and juvenile polychaete bioassays were initiated on April 16, 1999, 58 days after sample collection.

### **B.2.2 Data Evaluation**

Copies of the raw data forms were reviewed for completeness. Summary tables were reviewed for fidelity of transcription of the raw data. No errors or omissions were noted.

### **B.2.3 Bioassay Test Conditions**

Water quality parameters were compared to the PSEP (1995) and the PSDDA (1994) specifications. The water quality assurance parameters are summarized in Table 1 by test species and type.

Table 1 PSEP (1995) and PSDDA (1994) water quality assurance parameters for sediment bioassays.

<b>Parameter</b>	<b>Amphipod (<i>Ampelisca abdita</i>)</b>	<b>Juvenile Polychaete (<i>Neanthes arenaceodentata</i>)</b>	<b>Echinoderm Larval (<i>Strongylocentrotus purpuratus</i>)</b>
Temperature in °C	19 to 21	19 to 21	14 to 16
Salinity in ppt	27 to 29	28 to 35	27 to 29
Dissolved oxygen in mg/L	4 to 10	4 to 10	4 to 10
pH	7 to 9	7 to 9	7 to 9
Ammonia in mg/L unionized	0 to 1.0*	0 to 0.7	0 to 0.04
Sulfide in mg/L total	0 to 0.5	0 to 1.0	0 to 0.5

\* total ammonia for amphipods

### **B.2.4 Amphipod Bioassay**

There were no deviations of the water quality parameters for temperature, dissolved oxygen, or pH. Salinity had a minor water quality deviation in one of

the reference toxicant series. Salinity was outside the protocol-specified range by +1 ppt on one day during the test. It is doubtful that this water quality deviation had significant effects on the results.

Total ammonia values for the reference and control sediments were within the water quality parameters. The test sediment (C8) exceeded the PSDDA warning limit of 1.0-mg/L total ammonia in the overlying water on Day 1 and Day 10. Total ammonia concentrations increased from 3.27 mg/L at the test initiation to 5.19 mg/L at test termination. The test sediment should be flagged for possible ammonia toxicity.

All sulfide concentrations were below the critical limit of 0.5 mg/L specified by PSDDA.

### **B.2.5 Juvenile Polychaete Bioassay**

There were no deviations of the water quality parameters for temperature, salinity, dissolved oxygen, or pH. Unionized ammonia concentrations for the test, reference, and control sediments were below the critical value of 0.7 mg/L unionized ammonia specified by PSDDA. All sulfide concentrations were below the critical limit of 0.5 mg/L specified by PSDDA.

### **B.2.6 Sediment Larval Bioassay**

There were no deviations of the water quality parameters for temperature, salinity, dissolved oxygen, or pH. Unionized ammonia concentrations for the test, reference, and control sediments were below the critical value of 0.04 mg/L unionized ammonia specified by PSDDA. All sulfide concentrations were below the critical limit of 0.5 mg/L specified by PSDDA.

## **B.3 Bioassay Performance—Positive Control**

### **B.3.1 Amphipod Bioassay**

The reference toxicant 50 percent Lethal Concentration (LC50) for this test was 0.50 mg/L cadmium, within the PSEP range of 0.07 to 0.91 mg/L cadmium and within Parametrix's control chart limits.

### **B.3.2 Juvenile Polychaete Bioassay**

The reference toxicant LC50 for this test was 6.82 mg/L cadmium, within the PSDDA range of 6.0 to 19 mg/L cadmium but slightly below the PSEP-specified range of 7.1 to 17.9 mg/L cadmium. The LC50 value is within Parametrix's control chart warning limits of 3.72 and 12.53 mg/L cadmium.

### **B.3.3 Sediment Larval Bioassay**

The reference toxicant LC50 for this test was 0.96 mg/L cadmium and within Parametrix's control chart limits.

## **B.4 Bioassay Performance—Negative Controls and Reference Sediments**

### **B.4.1 Amphipod Bioassay**

Negative control mean mortality was <10 percent and was considered acceptable by the current PSDDA and SMS criteria. The mean mortality response of the reference sediment was 16 percent, within the PSDDA limit of  $\leq 20$  percent over negative control and the SMS limit of  $\leq 25$  percent over the negative control.

### **B.4.2 Juvenile Polychaete Bioassay**

Negative control and reference sample mortality was 0 percent and thus acceptable under the current PSDDA and SMS criteria. Mean individual growth rate in the control was  $\geq 0.38$  mg/individual/day and reference growth rate/control growth rate was  $\geq 0.80$ . Both were considered acceptable by the current PSDDA criteria.

### **B.4.3 Sediment Larval Bioassay**

The negative seawater control combined mortality/abnormality (19.8 percent) was <30 percent and was considered acceptable by the current PSDDA and SMS criteria. The mean combined mortality/abnormality for the reference sediment was 21.1 percent, normalized to the seawater control, well below the PSDDA limit of  $\leq 35$  percent.

## **B.5 Final QA Determination**

### **B.5.1 Amphipod Bioassay**

Testing for the amphipod bioassay using *Ampelisca abdita* began 58 days after sediment collection, which is slightly greater than the PSDDA holding time limitation and considerably longer than the 14 days recommended by PSEP (1995). In addition, the test sediment showed total ammonia levels at test initiation and test termination above the PSDDA warning level. Elevated ammonia levels may be the result of the extended holding times. The elevated ammonia levels do not appear to have resulted in significantly increased mortalities but should be flagged for possible ammonia toxicity effects. The

significant protocol deviation resulting from the exceedence of the holding time limitations does not appear to have compromised data quality. Toxicity has been documented to remain the same or to increase with holding times in excess of 8 weeks (Becker and Ginn, 1990, as reported in Kendall and Fox, 1991). Test results should be more ecologically conservative with extended holding times. The slight salinity elevation observed in the positive control test is judged to be a minor deviation and should not have significantly affected the result. The positive control, reference, and negative control tests met the applicable performance criteria. The data are judged to be of acceptable quality and usable for any application.

### **B.5.2 Juvenile Polychaete Bioassay**

Testing for the juvenile polychaete bioassay using *Neanthes arenaceodentata* began 58 days after sediment collection, which is slightly longer than the PSDDA holding time limitation of 8 weeks and considerably longer than the 14 days recommended by PSEP (1995). The positive control, reference, and negative control tests met the applicable performance criteria. The significant protocol deviation resulting from the exceedence of the holding time limitation indicates that the results of this test should be used with caution. Reduced growth rates may be the result of increased toxicity associated with extended holding times. The bioassay results should be judged to be ecologically conservative. Data are judged to be of acceptable quality. The protocol deviations do not appear to have compromised the quality of the results.

### **B.5.3 Sediment Larval Bioassay**

Testing for the sediment larval bioassay using *Strongylocentrotus purpuratus* began 55 days after sediment collection, within the 8-week PSDDA holding time limitation, but considerably longer than the 14 days recommended by PSEP (1995). The positive control, reference, and negative control tests met the applicable performance criteria. All data collected appear to be of good quality and usable for any application.

## **B.6 References**

Corps (US Army Corps of Engineers), 2000. Dredged material evaluation and disposal procedures: a users manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program. Prepared by the US Army Corps of Engineers, Seattle District, Seattle, Washington, US Environmental Protection Agency, Region X, Washington Department of Natural Resources, and Washington Department of Ecology.

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Kendall, D., and D. Fox, 1991. Modifications to holding time for biological testing [online report]. Dredged Material Management Program Issue Paper presented at the 3rd SMARM meeting. Dredged Material Management Office website [November 9, 1998].

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PSDDA (Puget Sound Dredged Disposal Analysis), 1994. Dredged analysis information system (DAIS), version 4.4. Electronic database from the US Army Corps of Engineers, Seattle District, Seattle, Washington.

PSEP (Puget Sound Estuary Program), 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Final report by PTI Environmental Services for US Environmental Protection Agency, Region X, Office of Puget Sound, Seattle, Washington.

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